

# Improving Disaster Response Through Disaster Simulation

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Disaster preparedness is a basic need of each region to reduce the risk of disasters that can occur without knowing the time and place. Therefore, prevention is needed with the right methods so that the risk of disasters that occur, especially regarding human victims, can be minimised. The target of this disaster simulation activity is the students of Malang State University. There were 85 participants in this activity. This disaster simulation activity was carried out with the following methods: (1) lecture; and (2) simulation. The disaster simulation activity was directly guided and directed by Indonesian Red Cross Malang Regency (PMI Kabupaten Malang Indonesia), assisted by a team of Voluntary Corps Indonesian Red Cross Unit Universitas Negeri Malang (KSR PMI Unit UM). The simulation refers to a scenario designed by the KSR PMI Unit UM. The conditions for handling disaster victims include: minor injuries, moderate injuries, serious injuries, and death victims. Handling of victims is guided by the distribution of disaster simulation teams (seven teams). The victim scenario is designed in such a way that aims to increase participants' understanding of the handling of injuries suffered by victims with various variations.

**Keywords:** *disaster simulation, disaster response*

## I. INTRODUCTION

Disaster response is an important factor in reducing the risk of loss due to disaster, especially death victims. Losses due to disasters include loss of property, and lives. Natural disasters that have occurred lately also caused many losses. The Regional Disaster Management Agency (BNPB) recorded: at least 1347 people dead in the Palu and Donggala tsunamis (BBC News, 2018b); the Lombok earthquake death toll reached 436 people, with material losses reaching Rp. 5 trillion (BBC News, 2018a); and the victims of the Sunda Strait tsunami was that 430 people were killed (BBC News, 2018c).

Disaster preparedness is a basic need of each region to reduce the risk of disasters that can occur without knowing the time and place. Therefore, prevention is needed with the right methods so that the risk of disasters that occur, especially regarding human victims, can be minimised. The prevention methods applied may differ in each region, because they are influenced by the geographical location of the area, the disasters that are prevalent in the area, and the social conditions of the community. Each region needs to review the appropriate methods for dealing with natural disasters.

Malang City is a city whose territory is located in the highlands and has the potential for disaster. The Regional Disaster Management Agency (BPBD) of Malang City recorded many disasters up to September 2017, as many as 87 disasters, including landslides dominating with 36 events; a whirlwind of 23 events; waterlogging as many as 11 events; and fires of 10 incidents (BPBD Kota Malang, 2017). The disaster caused damage to residential areas and public facilities, such as schools, places of worship, and bridges (Surya Malang, 2016).

Regulation of the Head of the National Disaster Management Agency Number 4 of 2012 concerning Guidelines for the Implementation of Schools / Madrasas Safe from Disasters categorises Malang City as an area that has an earthquake risk index with a high category and a maximum tsunami height of 11 meters with a tsunami arrival time of 29 minutes. If you look at natural disasters that have recently occurred, then disaster response is important to get priorities managed properly. Disaster response is the awareness, preparedness, and preparedness of people, both individually and in groups in dealing with disasters, with the aim of reducing risks and losses due to disasters.

The absence of a Standard Operating Procedure (SOP) and disaster management methods have an impact on the handling of disasters that are not appropriate and this will have an impact on the number of victims (News One, 2010). Campus as an educational institution is a home of learning for students, it is fitting to try to secure and protect all students from various disruptions that can occur, including the possibility of disasters that can occur at any time on campus. In an effort to encourage schools to build disaster preparedness, various institutions have carried out various disaster risk reduction education programs in educational institutions using their own developed methods.

Based on the analysis of the situation described, it can be seen that disaster preparedness is very much needed, including for educational institutions. Therefore, disaster preparedness simulations are needed in educational institutions, especially educational institutions located in disaster prone areas.



The purpose of disaster preparedness simulations in educational institutions is so that all members of educational institutions understand and are trained in dealing with emergencies and to minimize losses due to the disaster, such as loss of assets, property, and especially loss of life (Handayana, et al., 2016; Zahro, et al., 2017). The disaster alert simulation is also intended to ensure that all emergency equipment is always in a state of being ready to use and functioning properly (Handayana, et al., 2016).

No one expects disaster to occur, but disasters will still occur, regardless of natural disasters or because of human activities themselves. Disasters will continue to occur, so there is a need for massive efforts to always be on the lookout for possible disasters. Individual and collective awareness of the importance of disaster response is needed. Every person and community group in an area is expected to be able to recognise potential disasters in their respective regions. After recognising the potential of the disaster area, it is necessary to have disaster response efforts to minimise losses due to the disaster. Disaster preparedness is an attitude that is indispensable in dealing with disasters. If needed, the authorities in the region can collaborate with certain institutions for disaster alert programs, such as the Indonesian Red Cross and the Regional Disaster Management Agency (BPBD). Universitas Negeri Malang which is a campus located in Malang City with a total of 32 thousand students (Universitas Negeri Malang, 2017), certainly has an obligation to ensure that students feel safe from possible disasters especially when on campus. Therefore, disaster simulation needs to be done in the campus environment of Malang State University. This disaster simulation is a form of response to the mandate of the Ministry of Research, Technology, and Higher Education who requested that the campus have a disaster mitigation program (IDN Times, 2019). Disaster simulation is expected to increase students' awareness and understanding of the importance of disaster response, where the event does not recognise place and time. Whenever and wherever disasters can occur. This assumption underlies the importance of awareness of proper self-protection against the risk of disasters that can occur.

The purpose of natural disaster simulation is to: (1) provide knowledge about the hazards of natural disasters; (2) increase awareness of natural disasters; (3) checking the readiness of procedures and equipment for handling natural disasters; and (4) reduce the number of victims if a natural disaster actually occurs. Disaster simulations are used to practice preparedness in emergencies that will be anticipated (Levi, et al., 1998; Kaplan, et al., 2012; Hori and Ichimura, 2008). This simulation is designed to provide training, reduce confusion, and ensure preparedness of emergency response procedures and equipment. This natural disaster simulation can be in the form of: fire simulation; earthquake simulation; flood simulation; and tsunami simulations.

The main purpose of simulating natural disasters is to provide knowledge and increase awareness about the dangers of natural disasters (Hutchinson, et al., 2011; Cowan and Cloutier, 1988). If a community does not know about the risks of natural disasters in their area, the community will not prepare for disaster risk. Then when a disaster occurs, without any preparation there will be panic and many victims. Therefore, disaster simulations are often carried out in schools to educate young people about the dangers of disasters (Austin, et al., 2013; Wu, et al., 2008). The disaster simulation also



checks the readiness of procedures and equipment for handling natural disasters. For example, a fire simulation checks the evacuation flow of a building if there is a fire. Evacuation must be carried out properly and bring people to a safe gathering point. Fire simulations also check whether the APAR (light fire extinguisher) is available in the building and if it is functioning properly. With the disaster simulation, it is hoped that if a natural disaster actually occurs, there will not be many victims, because there is preparedness in facing the disaster.

Disaster education covers many important aspects about disaster. For example, the introduction of potential disasters around, history of disasters that have occurred, forms of anticipation, raising awareness of signs of disasters, the impact of disasters on individuals, families, and communities, how to deal with disaster conditions, and how to save themselves from disasters. Disasters can occur at any time without being able to be predicted beforehand, whether natural or social disasters. Through disaster education, it does not mean that the risk of disaster impact can be reduced so that it does not have any impact (Wu, et al., 2008; Chen, et al., 2011). The goals and expectations to be achieved through disaster education are achieving the minimum risk of disaster impact.

Some things to note are how many people have received disaster education? How many people recognise the potential for disasters that can occur? How many people recognise minor signs of disaster? What should people do if they get information from social media that a tsunami disaster will occur after an earthquake, a volcano erupts, or a conflict? What should the community do if a disaster occurs? Who is saved first when disaster strikes? Has the community ever received or participated in a disaster simulation which included how to save themselves and how to handle the first post-disaster? If you pay attention to the evacuation process of residents during the earthquake and tsunami, then everything happens with extraordinary panic in the people who are experiencing the disaster. However, there are differences in the level of panic. In Japan and some places where people are accustomed to being hit by a similar disaster, the level of panic is lower, different from people who have never experienced a disaster. High and low panic is determined by the severity of the disaster and one of them is also the knowledge of the community to anticipate, save themselves, and manage disasters.

For people who experience frequent disasters, they get the direct benefit, of learning about the disaster itself (Revet, 2013; Massaguer, et al., 2006). In the future if you experience a similar disaster you will be able to apply previous learning experiences. For people who have never been affected by a disaster, through learning about disasters, they become more aware of what to do quickly, and provide an emergency response (Gough et al., 2012; Takahashi, 2000; Wang, et al., 2012). Especially if you have ever done a real disaster simulation, so that even though the simulation situation and the reality are clearly different, there is confidence to be able to get useful supplies (Aschenbruck, et al., 2004; Green, et al., 2003; Tang and Wen, 2009). During this disaster simulation being carried out humanitarian organisations, governments, volunteer teams or other institutions have concerns related to disaster.

However, it does not cover the majority of Indonesian people, so there are still those who have not been able to take advantage of education. On the other hand, there are still people who do not feel the need for disaster education (Gul and Guneri, 2015; Gillett et al., 2008), so that when there is an opportunity to participate in disaster learning they do not take advantage of these opportunities. Anticipating and managing disasters is a shared responsibility, not only the responsibility of governments, humanitarian agencies, disaster management agencies, volunteers, and professionals. One of the ways to increase responsibility and participation, is the ability to anticipate and manage disasters through disaster education.

## II. METHOD

This disaster simulation activity will be carried out by: (1) seminar; and (2) simulation. The seminar method is used for giving material about disasters. The material to be provided is: (1) Introduction to Disaster Management; (2) Assessment; (3) Water and Sanitation (watsan); (4) First Aid; (5) Psico-Social Support Program (PSP) and Restoring Family Links (RFL); (6) Logistics and Distribution; (7) Public Kitchen; and (8) Temporary Shelter.

The simulation method is the participants being involved in a disaster, and is based on predetermined scenarios. Before a disaster simulation is carried out, there are net rehearsal activities that are used to prepare for disaster simulation activities. The implementation process for the disaster simulation activities for handling victims, involves dividing the simulation team into seven teams, namely: (1) command post; (2) disaster assessment; (3) shelter and watsan; (4) first aid and evacuation; (5) public kitchen; (6) logistics; and (7) PSP and RFL.

## III. RESULTS

The implementation of this disaster simulation activity is carried out in three stages, namely: (1) stage 1 submission of material on disaster; (2) stage 2 rehearsal in the context of implementing disaster simulation; and (3) stage 3 implementing the disaster simulation. The following outlines the results of the implementation of activities based on these three stages.

### Stage 1 Submission of Materials

In order to provide understanding to simulation participants about the importance of a disaster response, simulation participants are given disaster material traditionally. There are eight materials presented in this stage, namely: (1) Introduction to Disaster Management; (2) Assessment; (3) Water and Sanitation; (4) First Aid; (5) Psico-Social Support Program and Restoring Family Links; (6) Logistics and Distribution; (7) Public Kitchen; and (8) Temporary Shelter. The eight materials were compiled by a team from KSR PMI Unit UM in the form of material books.

The material was delivered by a team from KSR PMI Unit UM together with the team of lecturers. The objectives of the delivery of the material are: (1) providing insights to simulation participants related to disaster; (2) providing motivation to simulation participants to increase awareness in the surrounding environment against the threat of disasters occurring at any time; (3) providing insight

into the importance of improving environmental security and safety; and (4) training students to become disaster response pioneers.

### **Stage 2 Rehearsal Clean**

Before the disaster simulation is carried out, the simulation participant conducts a clean rehearsal of the disaster simulation. This rehearsal was under the direction of the KSR PMI UKM Unit of Malang State University Unit. Disaster simulation participants in the rehearsal activities were divided into seven teams, namely: (1) command post; (2) disaster assessment; (3) shelter and watsan; (4) first aid and evacuation; (5) public kitchen; (6) logistics; and (7) PSP and RFL. The division of simulation participants into seven teams related to the implementation of disaster simulation later. Each team has their respective duties in implementing a disaster response.

The Command Post Team is tasked with managing the overall relief activity for the victims and managing the disaster response administration. The post is a place to manage aid activities provided by volunteers to disaster victims. The Command Post Team has a duty to record everything related to disaster in the disaster area. The tasks of The Command Post Team include: (1) the field of operation; (2) the planning sector; (3) logistics, equipment and aid management; and (4) financial administration.

The Disaster Assessment Team is tasked with identifying and analysing specific situations related to disasters. The analysis such as: (1) the natural environment situation of pre-disaster, during disaster, and post-disaster; (2) psychological condition of disaster victims in recovering the trauma condition of victims of the disaster that occurred; (3) identify facilities that can still be used; (4) identify the immediate needs of disaster victims.

The Shelter and Watsan Team is tasked with finding safe shelter for disaster victims (especially for medical actions and anticipating post-disaster events) and managing the availability of sanitation water for the needs of disaster victims. Shelter for victims of this disaster is in the form of temporary shelter (emergency shelter). It also prepares emergency bathrooms and latrines for disaster victims. Occupancy and availability of clean water for disaster victims is very important for both physical and psychological recovery due to the disaster, especially when disaster management has not yet reached the recovery stage. . Temporary repressive housing for victims can reduce the burden of disaster victims.

The First Aid and Evacuation Team is tasked with providing first aid assistance to disaster victims prior to taking medical action by the authorities and providing evacuation assistance to disaster victims. Specific tasks related to first aid for victims are: monitoring victims who are evacuated at the gathering place, providing treatment if there are injured victims, and making referrals for victims to the hospital if necessary. While the specific tasks related to evacuation are: to record the number and condition of victims, immediately evacuate the victim's safety to the gathering place if there is an alarm sounding, convince the victim that the room or building that is prone to the impact of



aftershocks must be emptied, and make a presence or record the victim to the need for checking disaster victims.

The Public Kitchen Team is in charge of preparing the food and drink needed by the victims when a disaster occurs. Aspects that must be considered in the administration of Public Kitchens are: (1) availability of food for disaster victims, which includes quantity, quality, nutritional adequacy, free of substances that endanger the body, and in accordance with the culture of the local community; and (2) food availability can be reached on an ongoing basis and does not violate the rights of fellow disaster victims.

The Logistics Team is tasked with preparing the logistics needed for disaster management. The Logistics Team provides services: preparedness with the disaster management process; procurement and distribution of disaster victims assistance; and making effective efforts to provide disaster relief. Logistics managed by the Logistics Team include: health equipment, proper clothing, food, temporary shelter, water and sanitation. Therefore, logistical tasks include planning, procurement, receiving, transporting and distributing assistance to disaster victims.

The PSP and RFL teams are tasked with providing psychological relief for victims and searching for missing victims. The impact of disaster victims is not only the physical damage to the building, but also the social and psychological conditions of the victims. Handling aspects of the social and psychological conditions of victims needs to become the focus of our attention when handling disasters (without leaving aside other forms of assistance). Handling in this aspect at least reduces the trauma of the victim to the disaster that occurred. In addition, there is also the possibility of losing family members when a disaster occurs. The RFL identification service aims to search for disaster victims who are still missing based on information from family members.

### **Stage 3 Performing a Disaster Simulation**

After the simulation participants get stock and insight about disaster, the next step is the implementation of disaster simulation. This disaster simulation was carried out on Saturday 20 July 2019 in Coban Parangtejo, Kucur Village, Dau District, Malang Regency. Coban Parangtejo is about 20 kilometers from the centre of Malang City, East Java, Indonesia. The disaster simulation activity was directly guided and directed by PMI Malang Regency, assisted by a team of KSR PMI Unit UM. The simulation refers to a scenario designed by the KSR PMI Unit UM. The conditions for handling disaster victims include: minor injuries, moderate injuries, serious injuries, and death victims. Handling of victims is guided by the distribution of disaster simulation teams (seven teams, as described in stage 2 of the rehearsal). The victim scenario is designed in such a way that aims to increase participants' understanding of the handling of injuries suffered by victims with various variations. Simulated victim images and conditions for handling when a disaster occurs as in: Figure 1, Figure 2, Figure 3, and Figure 4.

There were 85 disaster simulation participants. If referring to the number of participants present in the implementation of this disaster simulation, it can be seen that the interest of students participating



in the simulation can be said to be good. It is important to increase awareness of personal safety where they are. This attitude is a form of one's own vigilance against the threat of disasters that may occur at any time. Safety is an attitude and awareness of disaster response as a group is needed in the community order.

#### IV. DISCUSSION

Natural disasters can occur suddenly or through a process that takes place slowly. Some types of disasters, such as earthquakes, are almost impossible to predict accurately including when and where they will occur and the magnitude of their strength (Curriculum Center, 2008). Educational institutions should also prepare their citizens to be ready in the face of disasters that can occur at any time. Disaster preparedness education institutions are educational institutions that have the ability to manage disaster risks in their environment (Consortium for Disaster Education, 2011).

This capability is measured by having disaster management planning (before, during and after a disaster), the availability of logistics, security and comfort in the educational environment, infrastructure, and emergency systems, which are supported by the knowledge and capability of preparedness, SOP, and early warning systems (Triyono and Koswara, 2012; Consortium for Disaster Education, 2011). This ability can also be reasoned through regular simulations by working together with various related parties institutionalised in the policies of the educational institution to transform the knowledge and practice of disaster management and disaster risk reduction to all members of the education unit as constituents of educational institutions (Consortium for Disaster Education, 2011). The parameters of the readiness of the educational institution was identified as consisting of four factors, namely: (1) attitudes and actions; (2) educational institution policies; (3) preparedness planning; and (4) resource mobilisation (Consortium for Disaster Education, 2011). An educational institution safe from disaster is an educational institution that implements standards of facilities and infrastructure as well as culture that is able to protect the citizens of educational institutions and the surrounding environment from the dangers of disasters. Disaster prepared education institutions are a form of education institution's concern in providing a sense of security and student protection against various disaster threats that can occur at universities. The sense of security of students on campus is very important, because it will affect the spirit of students studying on campus. Student safety is an important factor in organising university learning.

The application of educational institutions safe from disasters is mainly based on considerations: (1) reducing disruption to educational activities, so as to provide health, safety and eligibility guarantees for students with special needs, comfort and security in education units at all times; (2) safer learning places allow identification and support of other humanitarian assistance for students in emergencies through to post-disaster recovery; (3) can be used as a center of community activity and is a very important social tool in the fight against poverty, illiteracy and health problems; (4) can be the centre of community activities in coordinating response and recovery after a disaster occurs; and (5) can become an emergency home to protect not only the population of the education unit, but also the community where the educational institution is located.





The disaster response must be carried out systematically and continuously in order to form a collective awareness of the importance of disaster preparedness. Disaster simulation is one way to increase students' awareness and understanding of the importance of disaster response. Therefore, it is very important to carry out disaster simulation in the campus environment.

Disaster simulation is expected to be able to internalise the values of mutual assistance with fellow human beings due to disasters. This collective awareness of helping one another is very important, especially when a disaster occurs, because not everyone individually is prepared to face a disaster that can happen at any time. The emotion that commonly arises when disasters occur is panic (Health Crisis Center, 2016). Therefore, according to Wahyudi (2018) when a disaster occurs, people need to control panic. Through disaster simulation, it can be trained, so that people can at least save themselves first and help others when a disaster occurs. The existence of a disaster simulation does not guarantee people are survivors in the event of a disaster, but with a disaster simulation it is a real effort to improve disaster preparedness.

Disasters differ from danger or threat. Danger or threat implies damaging events either in the form of potential or events that have occurred. A danger can be said to be a disaster if the incident has damaged and harmed humans, for example, a flood hazard. Floods occur almost every time there in an occurrence of rain with high intensity in nature. Floods that occur in rivers in uninhabited wilderness are not a disaster in this sense, because they do not cause harm to humans.

Disasters also have another perspective, which concerns the loss / victim caused. Two disasters with the same large scale do not necessarily cause the same loss to humans. There is a human vulnerability factor in it that plays a role in determining the amount of loss caused. In the case of natural disasters, where the scale of the danger cannot be minimised, let alone controlled, the vulnerability factor greatly plays a role in reducing the impact of the disaster both in the form of material loss of property and casualties. It is these efforts to increase human resilience and preparedness to face disasters as mitigation efforts.

Some mitigation efforts that can be done are: research into potential natural hazards research, preparation of spatial planning, road building and transportation access, making evacuation points, preparing disaster resistant buildings, disaster awareness education for the community, preparedness of disaster management organisations and early warning systems. Disaster simulations can be done in two forms, the first is a simulation of the physical behavior of disaster events and and simulations when disasters occur. The first simulation involves experts in the field of disaster, especially those who study the physical phenomena of disasters. This phenomenon involves, the source of a disaster, its magnitude scale, its area of influence, its spread (in the case of a tsunami), the destructive power and the time humans have to respond to the disaster. These phenomena are usually analysed and made into one to see the interaction of one phenomenon with another. With the help of computer and technology advancements, various simulations of the phenomenon of disaster events can be easily compiled and seen responses to then be evaluated and used as a reference in order to prepare other mitigation activities for the better.

While the second simulation is useful to provide experience to the community on how best to act when a disaster occurs. The community is given an understanding and experience of disaster behavior, evacuation routes, thought patterns and actions that need or need not be done when a disaster occurs, utilise evacuation routes, utilise information systems that have been made before and the most important thing is deciding which actions should taken in that short amount of time with a good mentality.

Early disaster education needs to be done as a learning and introduction to disaster mitigation. It is hoped that the community, from children to adults, know and understand how to carry out rescue procedures. Natural disasters in Indonesia are common are very likely to occur repeatedly. The thing that needs to be done is to maintain a shared awareness, understanding and keep a positive attitude towards the disaster situation in order to minimise the impact and the victims.

Disaster mitigation is a term used to refer to all actions to reduce the impact of a disaster that can be taken before a disaster occurs, including preparedness and long-term risk reduction measures. Disaster mitigation is a series of efforts to reduce disaster risk, both through physical development and awareness raising and capacity to face the threat of disasters, in this case the threat of earthquakes, and aims to reduce and prevent the risk of loss of life and protection of property with structural and non-structural approaches.

Disaster mitigation activities are: (1) introduction and monitoring of disaster risk; (2) participatory disaster management planning; the development of a culture of disaster awareness; (3) application of physical, non-physical, and disaster management arrangements; (4) identification and recognition of sources of danger or threat of disaster; (5) monitoring of natural resource management; (6) monitoring of the use of high technology; (7) supervision of the implementation of spatial planning and environmental management; and (8) other disaster mitigation activities.

## **V. CONCLUSION**

Disaster simulation is very important to be carried out continuously and periodically by educational institutions, with the aim of increasing the sense of security of work and study at these educational institutions. On a small scale, at least students are equipped with basic level first-aid knowledge. The first handling of an accident affects the safety of a victim. A sense of security towards personal safety when on campus is very necessary. Disaster simulation can improve the attitude of the academic community. Disaster response is needed to reduce the risk of a disaster. Every disaster that occurs must result in losses, both material losses to the loss of human lives. Therefore, good preparedness is needed to minimise the impact caused by disasters.

**Figure 1 Death Victim**



**Figure 2 Victims of serious injuries**



**Figure 3 Minor Injury Victims**



**Figure 4 Victim Evacuation**





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